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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/361,980      | 07/28/1999  | ICHIRO ITO           | PM.262732           | 6217             |

7590 12/19/2001

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EXAMINER

UMEZ ERONINI, LYNETTE T

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 12/19/2001

Please find below and/or attached an Office communication concerning this application or proceeding.

MF-12

|                              |                         |                     |  |
|------------------------------|-------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b>  | <b>Applicant(s)</b> |  |
|                              | 09/361,980              | ITO ET AL.          |  |
|                              | <b>Examiner</b>         | <b>Art Unit</b>     |  |
|                              | Lynette T. Umez-Eronini | 1765                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-29,31 and 32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-4 is/are allowed.
- 6) ☐ Claim(s) 5-29,31 and 32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All   b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |                                                                                             |                                                                                           |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                 | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413) Paper No(s). <u>11</u> |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)        | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)               |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ | 6) <input type="checkbox"/> Other: _____                                                  |

### **DETAILED ACTION**

This action is a new non-final rejection. Previous rejection is withdrawn.

#### ***Information Disclosure Statement***

1. The information disclosure statement filed July 28, 1999 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because no English translation or equivalence was provided for Japanese reference lettered **OR**, **PR**, and **QR**. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

#### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 5, 6, 10, 26, 27, and 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Ruggiero (US 4,878,770).

Ruggiero teaches a method of etching a metallic film, comprising steps of:

forming a TiW barrier layer **24** (same as applicant's metallic film) on a thin film resistor (column 3, lines 24, 25, and 60);

forming an Al layer **28** (same as applicant's conductive film) on the TiW barrier layer **24** (metallic film) with a first opening exposing the metallic film thereon (column 3, lines 58-61).

A photoresist (not shown in Figure 5) is laid on the Al layer **28**, a wet-chemical etchant such as "PAN" (phosphoric, acetic and nitric acid) is applied to remove the non-masked portions of aluminum and another wet-etchant such as  $H_2O_2$  removes the corresponding portions of the barrier layer **24** (metallic film), (column 3, lines 61-68). In another embodiment plasma etching (dry etching) is employed to remove, simultaneously layers **22**, **24**, and **28** in the non-masked regions (column 4, lines 39-43), which reads on,

dry etching a second part of the metallic film through the first opening to expose the thin film resistor from the first opening, the second part underlying the first part and directly contacting the thin film resistor. Hence, a metallic layer that can be a metallic film or a barrier layer can be either wet or dry etched and would read on dry and wet etching the metallic film in claims 5, 6, 28, and 31.

#### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 1765

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 7, 8, 9, and 11-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ruggiero (US 4,878,770) as applied to claim 5.

Ruggiero differs in failing to specify recited processing parameters such as the thickness of the a first part and a second part of a metallic layer, **in claims 7, 8;**

the thickness of a metallic film, **in claim 11;**

the ratio of the upper surface area of the conductive film relative to an upper surface area of the thin resistor is more than 0.2, **in claim 12;** and

the ratio becomes less than 2.0 for a patterned conductive film that is patterned, **in claim 13.**

It would have been obvious to modify Ruggiero by employing a variety of processing variables such as the thickness and the ratio of the upper surface areas of a metallic layer and the ratio of the upper surface areas of a conductive film during patterning of the film. These variables are known in the etching art to affect the rate and quality and of the etching process. Conducting routine experimentation for the purpose of obtaining the best-etched product would optimize the selection of a particular value.

#### ***Claim Rejections - 35 USC § 103***

6. Claims 19-21, and 29, are rejected under 35 U.S.C. 103(a) as being unpatentable over by Nagahata (JP 63062746A, English Abstract) in view of Maghsoudnia et al. (US 5,420,063).

Nagahata teaches a method of etching a metallic film, comprising the steps of:

forming a glaze layer **2** (an insulation layer) on the surface of and a resistor layer **3** (thin film resistor) on an insulating substrate **1** (semiconductor). Figure **1a** shows a glaze layer (insulation layer) is interposed between the resistor and the semiconductor substrate. Forming aluminum conductor (metallic film) layers **5** and **6** on the glaze layer in a laminated state by oxidizing layer **5** to form the oxide film layer **7** which lies between layers **5** and **6**, reads on

forming a metallic film on the thin film resistor; and

oxidizing a surface portion of the metallic film to form a surface oxide layer on the metallic film.

A photoresist method is adapted to the conductor layer **6** to form lead conductors **6a** and **6b**, in an etching tank. Figures **1b** and **1c** show that the oxide film layer **7** and the conductor layer **5** (metallic film) are etched which reads,

patterning the conductive film to form an opening in the conductive film, the opening exposing the surface oxide layer there from; and

on wet-etching the surface oxide layer and the metallic film.

Nagahata differs in failing to teach the conductive film is made of a different metallic material than the metallic film, in claim **19**.

Maghsoudnia teaches forming a metal (such as aluminum, column 1, line 45-46) layer **68** over a TiW layer **58A** (column 3, lines 30-33 and Figure 17); wet etching through the metal **68** to the TiW layer **58A** (column 3, lines 54-58 and Figure **21**); and removing the TiW layer using a peroxide solution (column 4, lines 4-7 and Figure **23**).

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Nagahata by using Maghsoudnia's method to form different conductive and metallic films and to contact these films by wet-etching for the purpose of achieving small line widths of metallization lines, while providing for proper formation of resistor in the integrated circuit.

Nagahata differs in failing to teach the conductive film serves as an etching mask, **in claim 29.**

It would have been obvious to one having ordinary skill in the art at the time of the claimed invention to use a conventional mask material such as a metal, which makes up a conductive film for the purpose of obtaining the best etched product.

7. Claims 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahata (JP '746A).

Nagahata teaches the limitations as in claim 19 above.

Nagahata differs in failing to teach preparing different first and second metallic films that are laminated with each other; disposing an insulation film between the first and second metallic film and a specific surface of the second metallic film and exposing them by contacting with a specific solution to have a difference in electrode potential there between, **in claim 22.**

It is well known in the art that insulation film is formed on a metallic film. Forming an insulation film between two metallic film surfaces would have been obvious for the purpose of making metallic interconnecting structures such as plugs.



Art Unit: 1765

It is well known in the art that different metallic materials can be laminated and that metallic films possess a distinct electrode potential and charge and. Since metals are charged particles that conduct current, then it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to laminate different metallic films, which would have different electrode potential there between when contacting them with a specific solution.

8. Claims 31 and 32 rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahata (JP '746A) in view of Ruggiero (US '770).

Nagahata teaches a method of etching a metallic film, comprising the steps of:

forming a glaze layer **2** (an insulation layer) on the surface of and a resistor layer **3** (thin film resistor) on an insulating substrate **1** (semiconductor). Figure **1a** shows a glaze layer (insulation layer) is interposed between the resistor and the semiconductor substrate.

forming aluminum conductor (metallic film) layers **5** and **6** on the glaze layer in a laminated state by oxidizing layer **5** to form the oxide film layer **7** which lies between layers **5** and **6**, reads on forming a metallic film on the thin film resistor; and forming a conductive film on the insulating film

adapting a photoresist method to form lead conductors **6a** and **6b**, in an etching tank wherein Figures **1b** and **1c** show that the oxide film layer **7** and the conductor layer **5** (metallic film) are etched is the same as forming an opening in the conductive film to expose at least one of the insulation film and the metallic film through the opening; and



Art Unit: 1765

wet-etching the metallic film in a state where both the metallic film and the conductive film contact an etching solution.

Nagahata differs in failing to teach forming an insulation film on the metallic film.


It is well known in the art that insulation film is formed on a metallic film. Forming an insulation film on a metallic film would have been obvious for the purpose of making metallic interconnecting structures such as plugs.

***Allowable Subject Matter***

9. Claims 1-4 are allowed. The following is an examiner's statement of reasons for allowance: Prior art lacks a method of forming a mask on a conductive layer wherein the mask has a second opening that is smaller than the first opening and the mask opens in the first opening to expose an underlying metallic film, and etching a metallic film through the second opening.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner can normally be reached on Second Friday.

ltue  
December 17, 2001

  
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